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ABSTRACT

The effects of introducing a microcomputer into an elementary-school classroom were studied using a naturalistic paradigm. Initial questions investigated the impact of the microcomputer on children's behavior, interactions, and responses to available software; and on the teacher's role. Data were fathered through: weekly observation for 4 months; a 14-hour videotape recording of children using the microcomputer; a student questionnaire about preferences for alternative instructional media, microcomputer software, and partners when working on varied tasks; and interviews. Subjects were 12 students, ages 7 to 9, in a combined second and third grade classroom in a private elementary school in a small rural community in Southern Illinois. Themes emerged regarding differences in enthusiasm for the computer, sex differences, and age differences: (1) girls and boys alike expressed favorable attitudes toward the microcomputer, but boys were more interested in getting the machine to perform different functions; (2) among the older children, frequency of interaction surrounding the computer decreased during the study; (3) technical and logistical problems were frequent; and (4) introduction of the microcomputer placed many additional demands on the teacher. Thirteen references are listed. (LMM)

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Examining the Effects of the Microcomputer on a Real World Class: A Naturalistic Study

> We know as little today about the effects of computers as we did about TV's effects in the mid-1950s. However, based on the pace at which children are beginning to use computers and the anecdotal accounts of their appeal and educational effects, children's learning from microcomputers has become an important topic for research. The first empirical studies of microcomputers and children are now under way at many universities and research centers. (Chen, 1984, p. 270)

While not immediately apparent, Chen's (1984) comments contain a disturbing fact. In spite of the very rapid introduction of microcomputers into the nation's classrooms (Chen, 1984; Kurland, 1983), we know very little about the effects of their prolonged use. Much early writing has focused on cognitive aspects of using computers, especially the cognitive consequences of learning to program (Papert, 1980). But more recently, interest in the social aspects of using computers has emerged. There are at least two reasons why a consideration of the social aspects of this technology are pertinent. First, as Chen (1984) notes, few schools to date have been able to afford to provide a computer for every child. Therefore, of necessity most instruction involving the computer has taken place with children in small groups or in pairs. Second, contrary to early fears that

children working at computers would become isolated and too machine oriented, there has been some research indicating that computers encourage greater interaction and collaboration among children than traditional school instruction (Hawkins, 1983; Hawkins, Sheingold, Gearhart, & Berger, 1982; Sheingold, Hawkins & Char, 1984). Collaborative efforts among children have been lauded in the literature (Hawkins, 1983) and in Vygotsky's theories of cognitive development, but documentation of their occurrence with microcomputers is in its infancy.

The purpose of the study reported here was to describe and to analyze what happens when a microcomputer is introduced into an ongoing real world classroom. The research paradigm assumed was naturalistic. Initial questions of interest were: How do children behave when confronted with a classroom microcomputer? Does the microcomputer encourage children to interact? What kinds of interaction seem to be precipitated by the presence of the microcomputer? How do children respond to the available software? How does the microcomputer influence the role of the teacher in the classroom? As is typical of naturalistic studies, unanticipated questions of interest emerged during the investigation.

The following report begins with a brief discussion of the naturalistic paradigm. Then the setting in which the study took place is described. The following results section presents the themes that emerged during data collection and analysis. The report concludes with recommendations for additional research suggested by this study.

Methodology

The research paradigm assumed for the study was naturalistic. As Sheingold, Hawkins, and Char (1984) have noted, the social life of the classroom cannot be studied via experimentation alone. The use of experimental methods introduces control and intervention in the classroom that renders a disturbed rather than a naturally occurring setting. Furthermore, the complex and fluid nature of human interaction does not lend itself to control and quantification.

The rationale for using naturalistic inquiry to pursue studies such as this one has been described by Guba (1982), Guba and Lincoln (1983), Patton (1980), and others. Basically, the naturalistic paradigm is distinguished by three assumptions. The first is that reality is holistic--all parts influence all other parts. It is impossible to divide up reality into discrete variables as experimentalists do, holding some variables constant while manipulating others, without destroying the phenomenon under investigation. The second assumption is that the researcher must be involved with the phenomenon in order to understand it; the researcher tends to become the instrument rather than relying exclusively on tests, questionnaires, and other so-called objective devices. Third, context free generalizations or laws are not deemed possible by naturalistic inquirers. Rather they seek thorough description of phenomena so that working hypotheses may be applied to other similar settings.

The study reported herein sought to understand what happens when a microcomputer is introduced into an elementary classroom, not what <u>can</u> happen in a laboratory school, but what <u>does</u> happen in a real class. As is typical of naturalistic studies, several sources of data were examined. Observers

were present in the class approximately three hours a week for four months. In addition to their field notes the data base contains a fourteen hour videotaped record of the children using the microcomputer. The videotape was transcribed for analysis. All of the children were asked to complete a questionnaire regarding their preferences for alternative instructional media, microcomputer software, and partners when working on different kinds of tasks. The questionnaire was followed up with an individual interview of each child seeking clarification of their responses and additional, non-verbal information.

The study was conducted in a combined 2nd and 3rd grade classroom in a private elementary school. The school is located in a small rural community in southern Illinois. Twelve students, between the ages of seven and nine years of age participated in the study. Their teacher was completing her first year of teaching. She, like the children, had received a brief orientation to the computer and how to use it. In addition, an introduction to the available software was included in this orientation.

An informal, relaxed atmosphere pervaded the classroom with children working independently and confidently within it. Learning centers were available within the room, and children walked freely from one to the other in pursuance of their preassigned academic responsibilities for the day. The computer was introduced into the classroom as an additional center. A conscious attempt was made to insure all children had an opportunity to use the computer, and specific students were assigned to it singly, in pairs, or in small groups. When computer usage had not been specifically scheduled, optional access was available.

During a two week period prior to the initiation of the study, the two observers, the video operator, and the video equipment were introduced into

the classroom. The researchers became accepted as part of the class, while the children were allowed to become familiar with the camera and how it worked. Actual taping began the week immediately following this orientation and the introductory orientation to the computer. The camera was placed in a spot convenient to the computer. Since the study focused upon the computer and the children's interactions with and around it, it soon became apparent that the camera could be set and left virtually unattended during the course of each session. Thus, the unobtrusiveness of the equipment and operator was enhanced.

Data analysis followed a typical qualitative approach. The data were reviewed and tentatively coded. A content analysis was conducted, and themes in the data identified. At this writing the data analysis is far from exhausted. The results presented here are preliminary and further data analysis using alternative strategies progresses.

Results

The results of the study are described below as themes that emerged during data collection and analysis. The following results should be viewed as tentative. Their validity is threatened because, while the children were observed for a longer period of time than that frequently allowed in experimental studies, a much longer period would be required before confidence could be placed in the results. In spite of their limitations, the results provide a good starting point for forming hypotheses to be pursued in future research.

Differences in Response

Not surprisingly there appeared to be differences in the ways individual children responded to the microcomputer. Some of these differences are described below.

Differences in enthusiasm. Clearly not all the children responded to the microcomputer with the same level of interest. Such differences are not discussed in most of what is written about microcomputers; merely reading the microcomputer literature can leave one with the impression that all children are naturally drawn enthusiastically to this technology. Such a notion appears to be a myth. Detecting differences in interest level appears to require observation of children with computers. When children were asked during their interviews whether or not they liked the school's microcomputer, they all answered that they did. When asked on a questionnaire to choose among worksheets, television programs, and the microcomputer for work in math and in language, the computer was generally selected as the preferred medium, and was never the least preferred. However, when observing children at the microcomputer and during those periods of optional access, it was apparent that some had an avid interest in the machine, while others gave it only superficial and fleeting attention.

Sex differences. The results of this study lend some support to the sex difference in response to computers already suggested elsewhere in preliminary research (Becker, 1982; Hawkins, 1984). As noted above, observing children working with computers is essential for exploring these differences; when interviewed or asked on the questionnaire, girls and boys alike expressed favorable attitudes toward the microcomputer. However, the observation data seem to indicate a difference between the girls' and the boys' behavior at the machine. The boys seemed more interested in getting the machine to perform

different functions. Hawkins (1984) stated the phenomenon well, "Boys wanted to control it" (p. 12). The girls seemed more likely to use the drill and practice programs--to stay within the dictates of the established program rather than to explore the machine's capabilities. Hawkins (1984) has speculated that the sex difference may be due in large part to the curricular pairing of computers with math and science subjects, thus invoking the societal sanction against female involvement. However, during observations of the classroom viewed for this study, the microcomputer was never designated as a subject allied with either math or science. The available software involved language and music as well as math. These tentative outcomes do not appear to support Hawkins' hypothesis.

Age differences. Among older children, it appeared that the frequency of interaction surrounding the computer tended to decrease during the four months that the class was observed. A similar decrease, however, did not seem to occur among the younger children. This finding may be partially explained by the younger children's continuing need for assistance in simply operating the computer--loading the software and setting software parameters.

Class Management

Some of the study's results seem to have implications for class management.

Computer mechanics. An analysis of children's behavior and interaction when using the microcomputer revealed that a substantial portion of their 'computer time' was spent in simply trying to get the computer to run the chosen software. Technical and logistical problems were frequent. The teacher or the child 'expert' was called repeatedly to correct these problems. It was not uncommon for the teacher to call in the child 'expert' when the problem was one she could not handle. Children were observed waiting and

waiting and waiting for such assistance before they could progress through a program. Needless to say, such episodes seemed to generate frustration for the teacher as well as the children. Much of the time that the children spent at the computer was unproductive.

Computer rights. Also revealed by the analysis of children's interaction when using the computer was the surprising frequency with which the children had to assert verbally or nonverbally their right to control the computer keyboard. While the total amount of time taken by these squabbles was not great, their effect was to interrupt task oriented behavior. When more than two children were present at the computer, this behavior became even more pronounced. Hoarding of the keyboard, pushing away hands, and verbal reprimands were common in such situations. The child seated at the computer was frequently beseiged with 'advisers' usually offering conflicting advice. This situation may have been aggravated by a characteristic of microcomputers in schools noted by Sheingold, Hawkins and Char (1984) and by Hawkins (1983); microcomputers have not yet become an established part of the curriculum. Their legitimacy in the eyes of teachers and therefore also of students has not been confirmed. Consequently, children are more likely to interact freely where computer tasks are concerned; the taboos surrounding not doing one's own work seem not to have taken hold of computer tasks yet.

Role of the 'child expert'. The impact of microcomputers on formal educational settings is only now beginning to be studied, while the impact of personal computers on the home setting is yet to be explored. The accessibility of personal computers in the home has created the unique phenomenon of the child 'expert'.

The child 'expert' in the current study was called upon by peers and teacher alike for technical and logistical assistance. Many children appealed to him for approval of their creative endeavors. But, noticeably absent from

any of the resultant interchanges were the mature interactive behaviors one would expect from an adult teacher expert. Hyman (1974) states clearly: ".... there is an interpersonal aspect of teaching, in which the teacher must encourage learning and must himself respect 'intellectual integrity and capacity for independent judgement'" (p. 25). It would appear unlikely that many child experts would be capable of developing such a relationship with their peers. Thus, the role of the child 'expert' should be explored systematically.

Role of the teacher. This study seemed to indicate that the introduction of the microcomputer into the classroom placed many additional demands on the teacher. In addition to the more obvious demand that the teacher master the technology were the increased classroom management tasks. As noted above, the teacher was very frequently interrupted when working with other children to come to the aid of the child using the computer. The teacher's monitoring of the children's access to the machine also drew her frequent attention; she repeatedly had to instruct children to leave the computer area. Finally, choosing appropriate software for classroom use is an additional responsibility the teacher must assume.

Software evaluation. Char (1983) suggests three major criteria which should be used in determining the appropriateness of software for classroom use: comprehensibility, appeal, and usability. Observations of children's reactions to the available software in this study were analyzed in relationship to these factors.

Some children in the study frequently appeared confused not only by the general objectives of some of the software assigned them, but also by the mechanical processes involved in 'making the program run'. Others were clearly unchallenged by the same software, while a few children were interested,

challenged and obviously happy with the tasks presented them. These observations support Char's findings (1983) in suggesting the use of comprehensibility as an evaluative criterion in choosing software, and support the demand for a wide variety of software designed for various skill and conceptual levels.

As mentioned earlier, different software appealed to different children. While girls seemed to prefer drill and practice, boys appeared to prefer software which allowed for creative control of the computer. Responses of all children using drill and practice programs highlighted some unique problems for program designers. It was apparent that the program's 'positive' rewards for correct responses to the provided stimuli were not always appropriate for the individual user. Some children engaged in silliness as they made faces at the computer and mimicked the sounds it made in recognizing their success; some expressed disgust at the repetitiveness of the reward and actually lost sight of the drill and practice goals, intentionally making errors in order to change the computer's response; others expressed their boredom as they waited impatiently for the completion of the reward in order to get on with the rest of the program. Many available programs have overcome the difficulties associated with timing responses to meet individual performance needs, but more research is needed to discern appropriate and varied 'rewards' for successful task completion. It appears incorrect to assume that all children are highly motivated by the same rewards.

An earlier reference to the boys wanting to control the computer keyboard focuses on the third criterion, that of usage. The behaviors observed in this study support the need for the creation of more software which can be used effectively by more than one child at a time.

The naturalist research paradigm employed in this study allowed

observations of the interactions of children around a computer in a real classroom. Analysis of those observations suggests the need for further research into problem areas affected by the computer's presence in the classroom. Areas suggested for further study include: the relationship of differences in sex, age, and cognitive style to computer usage; the identification of additional demands upon the teacher for technical knowledge and skill in evaluating software effectively; the identification of the effects on a child of assignment to the role of class 'expert'; and, the design of more and varied software which meets the criteria for successful usage.

It was obvious throughout the study that the presence of a computer in the classroom is far from enough to assure advances in learning. The computer is merely another teaching tool whose success is dependent upon the way in which a well-prepared teacher can accommodate the additional knowledge, classroom management techniques, and software design awareness that s/he will need to use the computer effectively.

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